

WHAT IS CLAIMED IS:

1. A wiring circuit board comprising:  
a plurality of bumps each formed on a surface of a wiring layer directly or indirectly through an etching barrier layer;  
an insulating film formed on the surface of the wiring layer on which the bumps are formed at a portion in which the bumps are not formed; and  
a solder ball formed on a top face of each of the bumps directly or indirectly through an additional wiring layer.
2. A wiring circuit board according to claim 1, wherein the wiring layer, an additional wiring layer, and the bumps are made of copper.
3. A wiring circuit board according to claim 1 or 2, wherein:  
the insulating film has a bump formation region where the plurality of bumps are formed and a flexible bump non-formation region where the bumps are not formed; and  
the bump non-formation region can be bent or at least a part of the bump non-formation region is bent.
4. A wiring circuit board according to any one of claims 1 to 3, wherein:  
the top face of each of the bumps is formed in a rounded concave shape; and  
the solder ball is directly formed on the top face of each of the bumps.
5. A circuit module comprising:

a flexible wiring circuit board including:

a plurality of bumps each formed on a surface of a wiring layer directly or indirectly through an etching barrier layer;

an insulating film formed on the surface of the wiring layer on which the bumps are formed at a portion in which the bumps are not formed; and

a solder ball formed on a top face of each of the bumps directly or indirectly through an additional wiring layer; and

a rigid wiring circuit board having a rigid insulated board where a wiring layer is formed on at least one surface thereof, which is connected to the wiring layer,

wherein at least a part of the wiring layer of the flexible wiring circuit board and at least a part of the wiring layer of the rigid wiring circuit board are connected to each other through the solder ball.

6. A circuit module comprising:

a flexible wiring circuit board including:

a plurality of bumps each formed on a surface of a wiring layer directly or indirectly through an etching barrier layer;

an insulating film formed on the surface of the wiring layer on which the bumps are formed at a portion in which the bumps are not formed; and

a solder ball formed on a top face of each of the bumps directly or indirectly through an additional wiring layer; and

an additional flexible wiring circuit board having a flexible insulated board having at least one surface on which a wiring layer connected to the wiring layer is formed,

wherein at least a part of the wiring layer of the flexible

wiring circuit board and at least a part of the wiring layer of the additional flexible wiring circuit board are connected to each other through the solder ball.

7. A circuit module according to claim 5 or 6, wherein:  
the top face of each of the bumps is formed in a rounded concave shape; and

the solder ball is directly formed on the top face of each of the bumps.

8. A manufacturing method for a wiring circuit board comprising:

forming a board in which a bump is formed on a surface of a metal layer directly or indirectly through an etching barrier layer;

forming an insulating film on the surface of the metal layer on which the bump is formed at a portion in which the bump is not formed while making the insulating film thicker than the bump;

polishing the insulating film to an extent to which a top face of the bump is exposed; and

forming a solder ball on the top face of the bump.

9. A manufacturing method for a wiring circuit board comprising:

forming a board in which a bump is formed on a surface of a metal layer directly or indirectly through an etching barrier layer;

forming an insulating film on the surface of the metal layer on which the bump is formed at a portion in which the bump is not formed while making the insulating film thicker than the bump;

polishing the insulating film of the board to an extent to

which a top face of the bump is exposed;

forming an additional metal layer on a surface of the insulating film of the board;

selectively etching the additional metal layer to form a wiring layer; and

forming a solder ball on the top face of the bump directly or indirectly through the wiring layer connected to the bump.

10. A manufacturing method for a wiring circuit board according to claim 8 or 9, further comprising, before forming the insulating film, pressurizing the bump from above and flattening out the bump to increase a diameter of the top face of the bump.

11. A manufacturing method for a wiring circuit board according to any one of claims 8 to 10, further comprising, after polishing the insulating film to an extent to which the top face of the bump is exposed and before forming the solder ball on the top face of the bump, etching the top face of the bump into a rounded concave shape.

12. A circuit module comprising:

a single wiring circuit board including:

a plurality of bumps each formed on a surface of a wiring layer directly or indirectly through an etching barrier layer; and

an insulating film formed on the surface of the wiring layer on which the bumps are formed at a portion in which the bumps are not formed; and

a transparent board for a liquid crystal device which constitutes a board for the liquid crystal device and includes a

transparent wiring film,

wherein each of the bumps of the single wiring circuit board and a portion corresponding to the bump, of the transparent wiring film of the transparent board for the liquid crystal device are connected to each other directly or indirectly through the wiring layer formed on the top face of the bump and a solder ball thereon.

13. A circuit module according to claim 12, wherein:

the top face of each of the bumps of the signal wiring circuit board is formed in a rounded concave shape; and

the solder ball is directly formed on the top face of each of the bumps.

14. A manufacturing method for a wiring circuit board, comprising:

forming a board in which a bump is formed on a surface of a metal layer directly or indirectly through an etching barrier layer,

forming an insulating film by applying a liquid insulating material on the surface of the metal layer on which the bump is formed and solidifying the insulating material through heat treatment; and

removing the insulating film to an extent to which a top face of the bump is exposed.

15. A manufacturing method for a wiring circuit board using a multilayer metal plate in which a bump forming metal layer is formed on a wiring layer forming metal layer directly or indirectly through an etching barrier layer, comprising:

forming a bump by applying a resist onto the bump forming metal

layer and forming a resist mask through patterning, and etching the bump forming metal layer by using the resist mask as a mask;

removing the etching barrier layer through etching by using the bump as a mask after removing the resist mask;

forming an insulating film by applying a liquid insulating material on the surface of the metal layer on which the bump is formed and solidifying the insulating material through heat treatment; and

removing the insulating film to an extent to which a top face of the bump is exposed.

16. A manufacturing method for a wiring circuit board according to claim 14 or 15, wherein the insulating material is made of a precursor of a polyimide resin or an epoxy resin.

17. A manufacturing method for a wiring circuit board according to claim 14 or 15, wherein in forming the insulating film, an insulating material including a melted thermoplastic resin is applied on the surface of the board on which the bump is formed and solidified under cooling to form the insulating film.

18. A manufacturing method for a wiring circuit board according to claim 14 or 15, wherein in forming the insulating film, the liquid insulating material is applied onto the surface of the board on which the bump is formed, left standing to dry and solidify, leveled by a roll, and cured through heat treatment to form the insulating film.

19. A manufacturing method for a wiring circuit board

according to claim 14 or 15, wherein in forming the insulating film, a thermoplastic polyimide resin is applied onto the surface of the board on which the bump is formed and dried and solidified under heating, applied with a non-thermoplastic polyimide resin in a precursor form, and dried and solidified under heating to form the insulating film.

20. A manufacturing method for a wiring circuit board according to any one of claims 14 to 19, wherein in removing the insulating film, the insulating film is mechanically polished to an extent to which at least the top face of the bump is exposed.

21. A manufacturing method for a wiring circuit board according to any one of claims 14 to 19, wherein in removing the insulating film, a resist is applied onto the insulating film and the resist on the bump is removed through exposure and development, and the insulating film formed on the bump is removed through etching by using as a mask the resist applied onto a portion where the bump is not formed to an extent to which at least the top face of the bump is exposed.

22. A manufacturing method for a wiring circuit board according to any one of claims 14 to 19, wherein in removing the insulating film, the insulating film is wholly etched and removed to an extent to which at least the top face of the bump is exposed.

23. A manufacturing method for a wiring circuit board according to any one of claims 14 to 19, wherein in removing the insulating film, the insulating film formed on the bump is removed

by laser processing to an extent to which at least the top face of the bump is exposed.

24. A manufacturing method for a wiring circuit board according to any one of claims 14 to 19, wherein in removing the insulating film, the insulating film is removed by injecting a gas containing an abrasive onto the surface of the insulating film to an extent to which at least the top face of the bump is exposed.

25. A manufacturing method for a wiring circuit board according to any one of claims 14 to 19, wherein in removing the insulating film, the insulating film is removed by injecting a liquid containing an abrasive onto the surface of the insulating film to an extent to which at least the top face of the bump is exposed.

26. A manufacturing method for a wiring circuit board according to any one of claims 14 to 25, wherein in forming the insulating film, the insulating film is formed with a thickness larger than a height of the bump.

27. A manufacturing method for a wiring circuit board according to any one of claims 14 to 25, wherein in forming the insulating film, the insulating film is formed with a thickness smaller than a height of the bump.

28. A manufacturing method for a wiring circuit board using a board having a wiring layer forming metal layer and a bump formed on the wiring layer forming metal layer directly or indirectly through an etching barrier layer, comprising:



applying a material repelling a liquid resin onto a top face of the bump;

applying a liquid insulating material thereonto; and

solidifying the insulating material through heat treatment to thereby form an insulating film.

29. A manufacturing method for a wiring circuit board according to any one of claims 14 to 28, further comprising, after removing the insulating film, forming a protrusion made of metal on the top face of the bump by plating.

30. A manufacturing method for a wiring circuit board according to claim 29, further comprising, after forming the protrusion by plating, forming a wiring layer by partially etching the wiring layer forming metal layer.

31. A manufacturing method for a wiring circuit board according to any one of claims 14 to 28, further comprising, after removing the insulating film, forming a wiring layer by partially etching the wiring layer forming metal layer.

32. A manufacturing method for a wiring circuit board according to claim 31, further comprising, after forming the wiring layer, forming a protrusion made of metal on the top face of the bump by plating.

33. A manufacturing method for a wiring circuit board according to any one of claims 14 to 28, further comprising, after removing the insulating film:

laminating an additional wiring layer forming metal layer on the insulating film; and

forming a wiring layer by partially etching the additional wiring layer forming metal layer.

34. A manufacturing method for a wiring circuit board according to any one of claims 14 to 28, further comprising, after removing the insulating film, wholly removing the wiring layer forming metal layer through etching.

35. A manufacturing method for a wiring circuit board according to any one of claims 14 to 28, further comprising, after removing the insulating film:

partially forming a first metal film on the insulating film;  
forming a resistor film on the insulating film at a portion where the first metal film is not formed;  
forming a dielectric film on the first metal film;  
forming a second metal film on the dielectric film; and  
forming a wiring layer by partially etching the wiring layer forming metal layer formed on the wiring circuit board.

36. A manufacturing method for a wiring circuit board according to claim 35, wherein the first metal film and the second metal film are made of a conductive paste, the resistor film is made of a resistor paste, and the dielectric film is made of a dielectric paste.

37. A manufacturing method for a wiring circuit board according to claim 35, wherein the first metal film, the second

metal film, the resistor film, and the dielectric film are formed by one selected from the group consisting of a sputtering method, a CVD method, and an evaporation method.

38. A manufacturing method for a wiring circuit board according to any one of claims 14 to 28, further comprising, after removing the insulating film:

forming a wiring layer by partially etching the wiring layer forming metal layer to connect a part of the wiring layer with the bump directly or indirectly through the etching barrier layer; and

forming an electromagnetic shielding sheet wholly or partially on a surface on which the top face of the bump is exposed.

39. A manufacturing method for a wiring circuit board using a wiring circuit board manufactured by the manufacturing method for the wiring circuit board according to any one of claims 14 to 28, comprising:

forming a thin film made of metal on the insulating film and the top face of the bump by electroless plating or sputtering;

forming a metal film on the thin film by electrolytic plating; and

forming a wiring layer by applying a resist onto the metal film to form a resist pattern through patterning, and etching the metal film using the resist pattern as a mask.

40. A manufacturing method for a wiring circuit board using a wiring circuit board manufactured by the manufacturing method for the wiring circuit board according to any one of claims 14 to 28, comprising:

forming a thin film made of metal on the insulating film and the top face of the bump by electroless plating or sputtering;

forming a resist pattern by applying a resist onto the thin film and performing patterning;

precipitating metal by plating onto the thin film on which the resist pattern is not formed; and

removing the thin film by removing the resist pattern and wholly etching the film.

41. A manufacturing method for a wiring circuit board using a wiring circuit board manufactured by the manufacturing method for the wiring circuit board according to any one of claims 14 to 28, comprising:

forming a through-hole by removing a part of the insulating film on the wiring circuit board by laser processing or etching;

forming a thin film on the insulating film and the top face of the bump by electroless plating or sputtering;

forming a metal film on the thin film by electrolytic plating; and

forming a wiring film by applying a resist onto the metal film to form a resist pattern through patterning, and etching the metal film using the resist pattern as a mask.

42. A manufacturing method for a wiring circuit board using a wiring circuit board manufactured by the manufacturing method for the wiring circuit board according to any one of claims 14 to 28, comprising:

forming a through-hole by removing a part of the insulating film on the wiring circuit board by laser processing or etching;

forming a thin film on the insulating film and the top face of the bump by electroless plating or sputtering;

forming a resist pattern by applying a resist onto the thin film and performing patterning;

precipitating metal by plating onto the thin film on which the resist pattern is not formed; and

removing the thin film by removing the resist pattern and wholly etching the film.

43. A manufacturing method for a multilayer wiring circuit board using a wiring circuit board manufactured by the manufacturing method for the wiring circuit board according to claim 33, comprising:

forming a multilayer metal plate by laminating a wiring circuit board manufactured by the manufacturing method for the wiring circuit board according to claim 29, which has a protrusion formed on the top face of the bump directly or indirectly through a bonding sheet such that the protrusion comes into contact with the wiring layer; and

forming wiring layers on both of upper and lower surfaces of the multilayer metal plate by partially etching wiring layer forming metal layers formed on both of the upper and lower surfaces.

44. A manufacturing method for a multilayer wiring circuit board using a wiring circuit board manufactured by the manufacturing method for the wiring circuit board according to claim 33, comprising:

forming a multilayer metal plate by laminating a wiring circuit board manufactured by the manufacturing method for the wiring circuit board according to claim 27, in which a bump is formed such that a top face of the bump comes into contact with the wiring layer

directly or indirectly through a bonding sheet; and

forming wiring layers on both of upper and lower surfaces of the multilayer metal plate by partially etching wiring layer forming metal layers formed on both of the upper and lower surfaces.

45. A manufacturing method for a multilayer wiring circuit board using a wiring circuit board manufactured by the manufacturing method for the wiring circuit board according to claim 35, comprising, with respect to both of upper and lower surfaces thereof, on which wiring layers are formed:

forming a multilayer metal plate by laminating a wiring circuit board manufactured by the manufacturing method for the wiring circuit board according to claim 29, which has a protrusion formed on a top face of a bump such that the protrusion comes into contact with the wiring layer; and

forming wiring layers on both of upper and lower surfaces of the multilayer metal plate by partially etching the wiring layer forming metal layers formed on both of the upper and lower surfaces.

46. A manufacturing method for a multilayer wiring circuit board using a wiring circuit board manufactured by the manufacturing method for the wiring circuit board according to claim 35, comprising, with respect to both of upper and lower surfaces thereof, on which wiring layers are formed:

forming a multilayer metal plate by laminating a wiring circuit board manufactured by the manufacturing method for the wiring circuit board according to claim 27, in which a bump is formed such that a top face of the bump comes into contact with the wiring layer; and

forming wiring layers on both of upper and lower surfaces of the multilayer metal plate by partially etching the wiring layer forming metal layers formed on both of the upper and lower surfaces.

47. A manufacturing method for a multilayer wiring circuit board, comprising laminating on a wiring circuit board manufactured by the manufacturing method for the wiring circuit board according to claim 31, in which a wiring layer is formed, an additional wiring circuit board manufactured by the manufacturing method for the wiring circuit board according to any one of claims 14 to 28, in which a bump is formed such that a top face of the bump comes into contact with the wiring layer.

48. A manufacturing method for a multilayer wiring circuit board, comprising laminating on a wiring circuit board manufactured by the manufacturing method for the wiring circuit board according to claim 31, an additional wiring circuit board manufactured by the manufacturing method for the wiring circuit board according to claim 31, such that a top face of a bump of the additional wiring circuit board comes into contact with a wiring layer of the wiring circuit board.

49. A manufacturing method for a multilayer wiring circuit board, comprising laminating on a multilayer wiring circuit board manufactured by the manufacturing method for the multilayer wiring circuit board according to claim 48, a wiring circuit board manufactured by the manufacturing method for the wiring circuit board according to claim 34, in which a bump is formed such that a bottom face of the bump comes into contact with a wiring layer

of the multilayer wiring circuit board.

50. A manufacturing method for a multilayer wiring circuit board using a wiring circuit board manufactured by the manufacturing method for the wiring circuit board according to claim 31, comprising;

forming an insulating film by applying a liquid insulating material onto a surface where the wiring layer is formed and solidifying the insulating material through heat treatment;

forming a through-hole by removing a part of the insulating film by laser processing or etching;

forming a thin film on the insulating film by electroless plating or sputtering;

forming a metal film on the thin film by electrolytic plating; and

forming a wiring film by applying a resist onto the metal film to form a resist pattern through patterning, and etching the metal film using the resist pattern as a mask.

51. A manufacturing method for a multilayer wiring circuit board using a wiring circuit board manufactured by the manufacturing method for the wiring circuit board according to claim 31, comprising;

forming an insulating film by applying a liquid insulating material onto a surface where the wiring layer is formed and solidifying the insulating material through heat treatment;

forming a through-hole by removing a part of the insulating film by laser processing or etching;

forming a thin film on the insulating film by electroless plating or sputtering;

forming a resist pattern by applying a resist onto the thin



film and performing patterning;

precipitating metal by plating onto the thin film on which the resist pattern is not formed; and

removing the thin film by removing the resist pattern and wholly etching the film.